

REPORT ON REVEGETATION

TEST PLOT PROGRAM

BRUSH WELLMAN, INC.'S

TOPAZ MINING PROPERTY

023/003

September 20, 1985

Prepared for:

Brush Wellman, Inc.
67 West Century Pkwy.
Salt Lake City, Utah

Prepared by:

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DIVISION OF
OIL, GAS & MINING

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Introduction

In 1978 the staff of the Utah Division of Oil Gas and Mining, in conjunction with Brush Wellman, Inc., developed an experimental revegetative test plot program to investigate the requirements for reseeding tuffaceous material recommended for topsoil substitute. The tuffaceous material was extracted from the open pits as overburden and thus available as a substitute material to cover the waste rock dumps. Prior to seeding, this tuffaceous material was sampled and analyzed for standard fertility parameters. The SAR (sodium adsorption ratio) and ECe (electrical conductivity-saturation extract) were very high, up to 38 units and 57 mmohs/cm, respectively, indicating severe salt toxicity problems. Nitrogen and phosphates were low, indicating the need for fertilization. Complete test results are shown in Appendix I.

Test Plot Program

The seeding program was undertaken by Brush Wellman' Inc. in 1978 under the following criteria:

1. Test plots were located on three waste rock dump sites.
2. Two plots were installed at each site; one on the slope, and one on the flat top.
3. The soil surface was graded, scarified, and fertilized at various rates; from 35 to 75 lbs./acre for nitrogen and from 100 to 140 lbs./acre for phosphate.
4. A straw mulch of 2,000 lbs./acre was crimped into the soil surface.
5. The following seed mix was used:

<u>Seed Type</u>	<u>Application Rate (lbs/acre)</u>
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Grasses

Russian wildrye (<i>Elymus junceus</i>)	2
fairway crested wheatgrass (<i>Agropyron cristatum</i>)	2
standard crested wheatgrass (<i>Agropyron cristatum</i>)	2
Indian ricegrass (<i>Oryzopsis hymenoides</i>)	1

Shrubs

winterfat (<i>Ceratoides lanata</i>)	2
fourwing saltbush (<i>Atriplex canescans</i>)	2
Cardinal autumn olive (<i>Elaeagnus umbellata</i>)	0.5

Legumes

yellow sweetclover (<i>Melilotus officinalis</i>)	2
nomad alfalfa (<i>Medicago sativa</i>)	1

Forbs

wild sunflower (<i>Helianthella uniflora</i>)	<u>0.5</u>
Total	15

Please see Appendix II for complete test plot details.

Results

The test plots were maintained, but not evaluated between 1978 and 1985. To acquire data on the plots and test the effectiveness of the program, 100-foot line-intercept transects were run on the surviving plots in July, 1985. The results of these transects are shown below:

<u>Test Plot</u>	<u>Species</u>	<u>#</u>	<u>%</u>	<u>Total Groundcover</u>
Blue Chalk slope	Agropyron cristatum	2	2.2	7.6%
	Sitanion hystrix	1	0.1	
	Halogeton glomeratus	1	0.1	
	Atriplex canescans	3	<u>5.2</u>	
	Litter	-	1.0	
	Rock	-	1.2	
	Bare	-	90.2	
Blue Chalk flat top	Agropyron cristatum	2	1.2	5.0%
	Halogeton glomeratus	1	0.4	
	Atriplex canescans	1	<u>3.4</u>	
	Litter	-	1.0	
	Rock	-	1.5	
	Bare	-	92.5	
Roadside slope	Agropyron cristatum	7	3.7	9.2%
	Bromus tectorum	5	2.2	
	Halogeton glomeratus	10	1.9	
	Medicago sativa	4	1.1	
	Atriplex canescans	1	<u>0.3</u>	
	Litter	-	5.9	
	Rock	-	1.0	
	Bare	-	83.9	

Discussion

The years 1978 to 1985 were good precipitation years in west-central Utah with 1978, 1983, and 1984 having been excellent years for plant growth. All of these years had above average spring and summer precipitation that provided adequate soil moisture for seed germination and plant growth. The test plot soils were sampled again in 1985 to determine if a second soil analysis substantiated the original analysis and also to assess the affects of weathering on the substitute soil material. The SAR's and ECe's were still in the salt toxic range as originally reported in 1978 (See Report on Investigation of Soils, 1986, by JBR Consultants Group).

The growth of the seeded species in the plots was weak and provided little plant cover. The exception was fourwing saltbush which, while few in number, were generally vigorous plants. The total plant cover did not protect the soils or prevent rill erosion on the slopes of the dumps. The seeded species did not appear to be reproducing and establishing new plants.

The 5%, 7.6%, and 9.2% total groundcover in the test plots does not meet the requirement of rule M-10 which calls for 70% of the surface cover in the representative vegetative communities surrounding the mine. Total mean groundcover of indigenous, undisturbed plant communities ranges from 24.3% to 37.5%. Also, the low number of species established does not meet rule M-10's species diversity requirement. Apparently the salt toxicity of the tuffaceous soil substitute material and the low annual precipitation in the area prohibits the establishment of adequate groundcover on these waste dumps.

APPENDIX I

UTAH STATE UNIVERSITY · LOGAN, UTAH 84322

SOIL, PLANT and WATER
ANALYSIS LABORATORY
UMC 48



File in
Brush
Wellman's
Topaz Project

August 23, 1978

Route & File
in Brush Wellman
ACT/023/003

Division of
1588 W. No
Salt Lake City, Utah 84116

Data report on soil samples logged in 8/11/78.

1-6" depth

Ident	pH	ECE mmhos/cm	NaHCO ₃ -P ppm	NaHCO ₃ -K ppm	Lime	Est. Texture	meq/l in Sat. Extract Ca + Mg Na	SAR
1A	8.1	1.0	4.0	218	0	Clay	1.2 9.1	+ 12
B	8.0	.8 Salt	3.7	>320	0	Clay	.7 7.4	+ 13
C	7.4	8.9 Toler-	3.7	277	0	Clay	24.6 65.2	(19)
D	7.4	4.9 ant	2.5	>320	0	Clay	14.3 33.0	(23)
2A	7.3	(45)	4.2	>320	+	Clay	139 313	(38)
B	7.5	30 Salt	3.3	268	++	Clay	93.6 196	(29)
C	7.3	57 Toxic	3.7	228	++	Clay	215 374	(36)
D	7.8	22	4.0	187	++	Clay	75.1 134	(22)
3A	7.9	8 Toler-	3.0	>320	+	Sandy C Loam	10.8 60.4	(26)
B	7.8	16 ant	3.5	>320	+	Sandy Loam	31.7 123	(37)
C	7.6	31 Salt	5.0	>320	+	Sandy C Loam	103 200	(28)
D	8.0	46 Toxic	3.7	>320	++	Clay Loam	148 322	(38)
4A	8.4	.8	4.7	>320	+	Sandy Loam	1.3 7.8	9.
B	8.3	.7 Salt	4.8	>320	0	Sandy C Loam	.7 7.4	+ 13
C	7.5	9.7 Toler-	4.4	>320	0	Sandy Loam	43.3 65.2	+ 14
D	7.7	1.9 ant	5.8	>320	0	Sandy Loam	2.9 15.7	+ 13
V	7.9	4.2	45	40	++	Sandy Loam	31.5 21.3	5.4

Comments:

pH. All are in normal range, although 4A and 4B are higher than most.

ECE. Salinity lab interpretation: 0-2, negligible effect; 2-4 sensitive crops affected; 4-8 many crops affected; 8-16 only tolerant crops; above 16 toxic to most domestic crops.

NaHCO₃-P. (phosphorus) All except 4V are marginal to low, even for grasses.

NaHCO₃-K. (potassium) All except 4V have ample K. No. 4V is very low.

Lime. None needed on any sample

SAR. (sodium adsorption ratio, calculated from Ca + Mg and sodium in the saturation extract). 0-10 usually not a serious problem; 10-15 some problems on some soils; above 15 usually appreciable to serious problems with toxicity, water infiltration rate, etc.

serious problems w/ toxicity, fill in

APPENDIX II

*Lyons
File in
Land Reclamation
Div of Oil, Gas & Mining*

Revegetation Test Plots
Experimental Design
for
Brush Wellman, Inc.
Topaz Mining Property
Juab County, Utah

December 22, 1977

Prepared By
Utah Division of Oil, Gas, and Mining
James W. Smith, Reclamation Soils Specialist

Introduction

Experimental revegetation test plots will be established on Brush Wellman, Inc. Topaz Mining Property in Juab County, Utah with the purpose of determining a feasible revegetation program for reclaiming disturbed areas. This test program will be a joint effort conducted by Brush Wellman, Inc. and the Division of Oil, Gas, and Mining, with all expenses being the responsibility of Brush Wellman, Inc.

The vegetation used in this experimental program will be a composition of species representative of the area and tolerant of the existing soil and climatic factors.

The areas involved in the experiment will be the three existing waste dumps; the Roadside, the Blue Chalk, and the Fluoro dumps. The dumps are overlain by tuffaceous rock which weathers rapidly to a sandy clay, with a high proportion of clay. As shown by laboratory analyses this material is highly nutrient deficient and will require the addition of nitrogen and phosphorous. Potassium will not be required.

Experimental Design

The experimental design will entail all three dump areas, involving a total of 2.07 acres, to take into account the age and degree of weathering of each dump. There will be two plots per dump to determine the affect of slope and degree of erosion control; one on a relatively flat surface and one on a sloping surface. Each plot will be 100 feet by 150 feet (approximately 0.34 acres) and will be divided equally into three subplots (approximately 0.115 acres) to accommodate a corresponding number of different fertilizer levels. See figure 1 for example of plot design and Table 1 for fertilizer application rates and locations. The type of fertilizer to be used will be the discretion of Brush Wellman, Inc.

The same seed mixture and application rates will be used on all plots. See Table 2 for seed mixture composition and application rates. A list of seed supplier and approximate costs of the seed involved in this program is included in the appendix.

Site Preparation

The surface of each selected area will be graded, scarified, and fertilized. Seeding will be done by the broadcast and drag method. Each plot and subplot will be staked with some type of semi-permanent markers for future reference points.

Alternative Suggestions

A straw mulch at a rate of 2,000 lbs/ac may be used to assist in curbing soil erosion while vegetation is becoming established. It could be applied prior to seeding using a tractor with a disk and would involve approximately 50 to 60 bales.

Fencing of the experimental plots to protect them from grazing activities could also be employed if necessary.

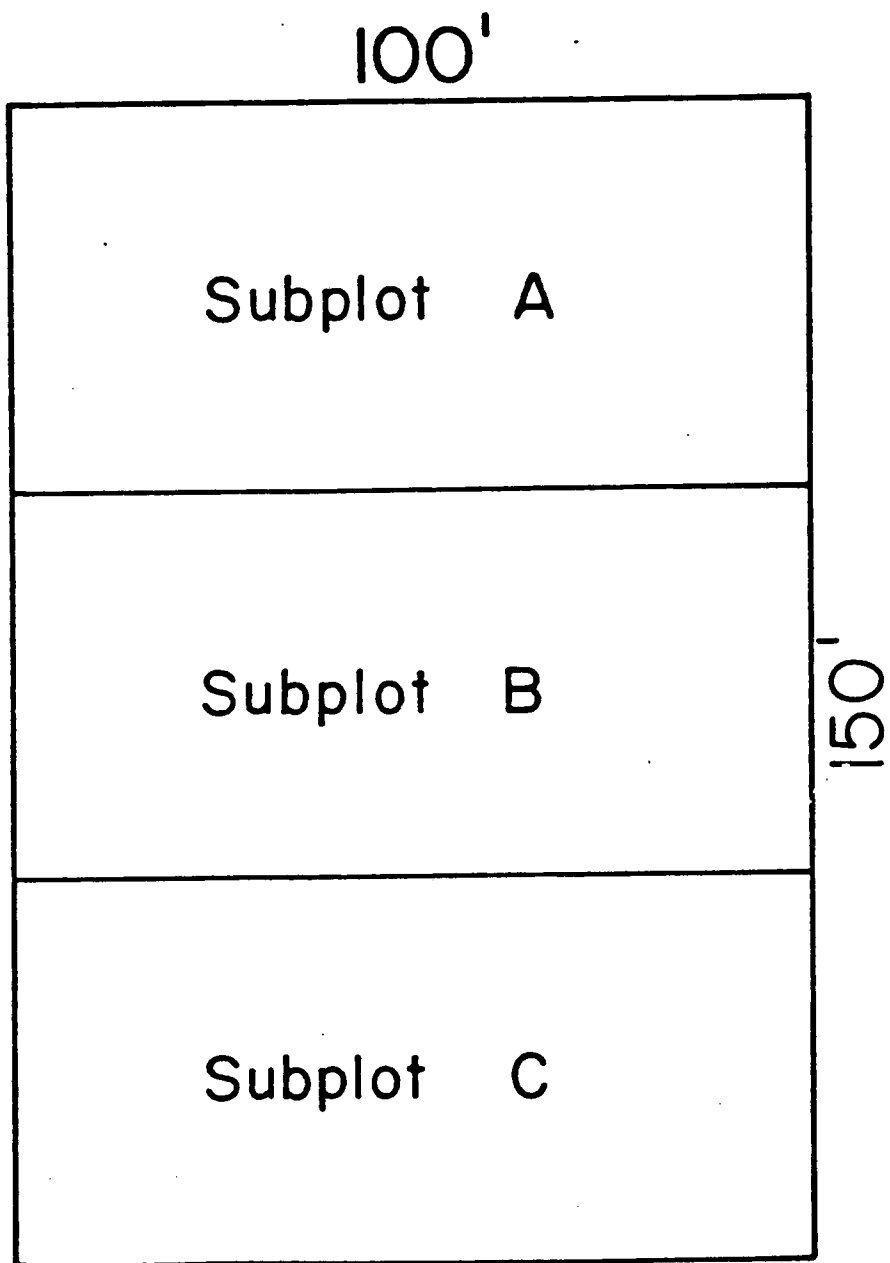


Figure I. Plot Arrangement

<u>Location</u>	<u>Element</u>	Rate (pounds/acre)
Subplot A	Nitrogen	35
	Phosphorous	100
Subplot B	Nitrogen	55
	Phosphorous	120
Subplot C	Nitrogen	75
	Phosphorous	140

Total approximate pounds of nitrogen required - 115

Total approximate pounds of phosphorous required - 250

Table 1 fertilizer application rates and locations.

<u>Species</u>	<u>Application Rate</u> <u>(pounds/acre)</u>
<u>Grasses</u>	
Russian Wildrye (<i>Elymus junceus</i>)	2
Fairway Crested Wheatgrass (<i>Agropyron cristatum</i>)	2
Standard Crested Wheatgrass (<i>Agropyron cristatum</i>)	2
Indian Ricegrass (<i>Oryzopsis hymenoides</i>)	1
<u>Shrobs</u>	
Winterfat (<i>Eurotia lanata</i>)	2
Fourwing Saltbush (<i>Atriplex confertifolia</i>)	2
Cardinal Autumn Olive (<i>Elaeagnus umbellata</i>)	0.5
<u>Legumes</u>	
Yellow Sweetclover (<i>Melilotus officinalis</i>)	2
Nomad Alfalfa (<i>Medicago sativa</i>)	1
<u>Forbs</u>	
Wild' Sunflower (<i>Helianthella uniflora</i>)	<u>0.5</u>
TOTAL	15

Table 2 Seed composition and application rate.

Appendix

Approximate seed costs as quoted by Mr. Lloyd Stevens, Stevens Bros. Ephraim, Utah, December 20th, 1977.

<u>Species</u>	<u>Cost/Pound</u>
Russian Wildrye	\$12.00 - \$16.00
Indian Ricegrass	"
Fairway Crested Wheatgrass	0.75 - 1.00
Standard "	"
Winterfat	4.00
Fourwing Saltbush	2.00 - 2.25
Little Sunflower (wild)	2.00
Yellow Sweetclover	1.00 - 2.00
Nomad Alfalfa	"
Cardinal Autumn Olive *	8.00

* Quoted by Ms. Claire Gabriel, Native Plants, Salt Lake City, Utah, December 19th, 1977.

The total approximate costs for seed should be somewhere between \$90.00 and \$120.00.

WILDLAND PLANT SEED

Collectors & Producers

- 1) CLYDE ROBIN SEED COMPANY, INC.
Mr. Steven R. Atwood, Vice Pres.
P.O. Box 2091
Castro Valley, California 94546
- 2) LONGMONT SEED COMPANY
51 Brown Street
P.O. Box 923
Longmont, Colorado 80501
- 3) ARKANSAS VALLEY SEEDS, INCORPORATED
Mr. Robert C. Appleman, President
(303-254-7469)
P.O. Box 270
Rocky Ford, Colorado 81067
- 4) NORTHPLAN SEED PRODUCERS
Mr. Loring M. Jones
P.O. Box 9107
Moscow, Idaho 83843
- 5) GLOBE SEED & FEED COMPANY
Mr. L.H. Haslam
Truck Lane
Twin Falls, Idaho
- 6) ~~SHAYS~~ **SHARP** BROS. SEED COMPANY
Mr. Gail E. Sharp
(316-398-2231)
~~Healy~~, Kansas 67850
Healy
- 7) E.C. MORAN
Stanford, Montana 59479
- 8) JACKLIN SEED COMPANY (Division of The Vaughan-Jacklin Corp.)
Mr. John Thorne, Ph.D., Research Director
(509-926-6241)
E. 8803 Sprague Avenue
Spokane, Washington 99206

Wildland Plant Seed
Collectors & Producers
Page Two

UTAH

- 9) HORSELY-CUMMINGS SEED COMPANY
Mr. Dave Cummings
(801-723-5246)
P.O. Box H
Brigham City, Utah 84302
- 10) Gary Jorgenson
Ephraim, Utah 84627
- 11) John Plummer
Ephraim, Utah 84627
- 12) STEVENS ENTERPRISES ~~BROS.~~
S. Lloyd Stevens
P.O. Box 496
Ephraim, Utah 84627
- 13) Roger Stewart
Ephraim, Utah 84627
- 14) Native Plants
P.O. Box 15526
Salt Lake City, Utah 84115
(801) 466-5332
Claire Gabriel
Seed Specialist

This page is a reference page used to track documents internally for the Division of Oil, Gas and Mining

Mine Permit Number MA230003 Mine Name Topaz Mining Property
Operator Brus Wellman, Inc. Date 1-12-1987
TO _____ FROM _____

☐ CONFIDENTIAL ☐ BOND CLOSURE ☐ LARGE MAPS ☒ EXPANDABLE
☐ MULTIPUL DOCUMENT TRACKING SHEET ☐ NEW APPROVED NOI
☐ AMENDMENT ☐ OTHER _____

Description

YEAR-Record Number

☐ NOI ☒ Incoming ☐ Outgoing ☐ Internal ☐ Superceded

Report of Revegetation
2 Reports

☐ NOI ☐ Incoming ☐ Outgoing ☐ Internal ☐ Superceded

☐ NOI ☐ Incoming ☐ Outgoing ☐ Internal ☐ Superceded

☐ NOI ☐ Incoming ☐ Outgoing ☐ Internal ☐ Superceded

☐ TEXT/ 8 1/2 X 11 MAP PAGES ☐ 11 X 17 MAPS ☐ LARGE MAP

COMMENTS: _____

CC: _____